

REMARKS

Upon entry of the amendments herein, claims 1, 10-11, and 19-20 will be under examination. Claims 9 and 12 have been canceled. Claims 19-20 have been added. No new matter has been added. The amendment to claim 1 is supported by the specification at page 8, line 4, page 11, lines 2-3 after the Table, page 16, lines 11-12, page 18, lines 13-14, the paragraph bridging pages 19-20, and by original claim 9. The specification supports new claims 19 (page 24, row 6 in Table) and 20 (page 24, row 13 in Table).

As per 37 C.F.R. § 1.121(c)(1), amendments are presented in clean form in the body of this filing and in marked-up form in the attached Appendix.

I. The Rejections Under 35 U.S.C. § 112, 2nd Paragraph

The claims stand stand rejected as indefinite under the second paragraph of 35 U.S.C. § 112 on various grounds.

1. "Free Radical Initiator"

Claims 1 and 9-12 stand rejected as indefinite under the second paragraph of 35 U.S.C. § 112. Applicants have obviated this rejection by amending claim 1 to exclude specific radical initiators.

2. "Oxirane (Epoxide)"

Claim 9 stands rejected as indefinite under the second paragraph of 35 U.S.C. § 112. The Office questions the term "oxirane (epoxide) rings" (Office Action, page 5, paragraph No. 8). Applicants have obviated this rejection by canceling claim 9.

3. *Recitation Of "Functionality"*

Claims 1 and 9-12 stand rejected as indefinite under the second paragraph of 35 U.S.C. § 112. The Office questions the recitations of "functionality" in a) and e) of claim 1, a1) of claim 10, and a) of claim 11 (Office Action, page 6, paragraph No. 9). Applicants have obviated this rejection by amending the claims to specify the functionality referred to.

4. *Compounds "Having At Least 2 Hydroxy Groups"*

Claims 10-11 stand rejected as indefinite under the second paragraph of 35 U.S.C. § 112. The Office questions the definition referring to compounds "having at least 2 hydroxy groups" (Office Action, paragraph No. 10 bridging pages 6-7). Applicants have obviated this rejection by amending the claims to specify that component d) is the product of a reaction of the recited compounds.

5. *Variable "X" In Claim 12*

Claim 12 stands rejected as indefinite under the second paragraph of 35 U.S.C. § 112. The Office questions the definitions of the variable "x" in claim 12 (Office Action, page 7, paragraph No. 11). Applicants have obviated this rejection by deleting the definitions of "x" and "y" in claim 12 on page 32 under (C-X).

6. *Clarification Of Component "C" In Claim 12*

The Office requests clarification on what is intended regarding c) in Claim 12 (Office Action, paragraph bridging pages 7-8).

Applicants do not intend to define c) to include compounds having no hydroxyl groups. The limitations of claim 1 necessarily apply to claim 12, which depends from claim

1, so at least one hydroxy group must be present in component c) as defined in part iv) of claim 12.

II. The Rejection Of Claims 1 And 9 Under 35 U.S.C. § 102(b) Over Liu

Claims 1 and 9 stand rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,147,727 (“Liu”).

Applicants have obviated this rejection by the amendment to claim 1, because the formulation disclosed in Liu does not satisfy all the limitations of claim 1 as amended. Claim 9 has been canceled.

Claim 1 as amended recites “a) 40 to 80 percent of one or more than one compound having at least two epoxy groups” and “d) 5 to 40 percent by weight of a hydroxy compound having no unsaturated groups.”

Liu discloses no liquid composition that contains both component a) and component d) of claim 1 as amended. Applicants could find only a single example of a liquid composition that is cured in Liu, but Liu does not disclose any components of that composition other than the divinyl ether used (column 5, lines 45-60). Liu therefore could not anticipate claim 1 as amended. The Office should therefore withdraw the rejection under § 102(b).

The Office did not reject any claims as obviousness over Liu. However, a person of skill in the art would have found no guidance to modify the Liu disclosure by incorporating both components a) and b). The single example in Liu of curing a formulation has no details other than the divinyl ether used, leaving a person of skill in the art with no guidance about

combinations of additional components. Consequently, the formulation of claim 1 as amended would not have been obvious to a person of skill in the art.

III. The Rejection Of Claims 1 And 9 Under 35 U.S.C. §§ 102(b) and 103(a) Over Ohe

Claims 1 and 9 stand rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,698,345 (“Ohe”).

Applicants have obviated this rejection by the amendment to claim 1 and by canceling claim 9.

Claim 1 as amended recites a sulfonium salt (component b) and a hydroxy compound having no unsaturated groups (component d). Ohe mentions sulfonium salts in a long list of optional photoinitiators (col. 15, line 67, and col. 16, lines 38-44) but never uses a sulfonium salt in the Examples. Ohe does not disclose “d) 5 to 40 percent by weight of a hydroxy compound having no unsaturated groups” as recited in claim 1 as amended. Ohe thus fails to meet at least two limitations of claim 1 as amended, and therefore Ohe’s disclosure is not anticipatory.

Claim 1 as amended would have been non-obvious over Ohe because a person of skill in the art would have found no guidance or motivation to modify the Liu formulations by incorporating both components b) and d).

For the reasons given above, Applicants submit that claim 1 as amended would have been novel and non-obvious over Ohe.

IV. The Rejection Of The Claims Under 35 U.S.C. § 103(a) Over Melisaris And Other References

The claims stand rejected under 35 U.S.C. § 103(a) over WO 99/50711 ("Melisaris") in view of Liu. While the Office refers to U.S. Patent No. 6,136,497 in the Office Action, the patent is not prior art because it is only available under 35 U.S.C. § 103(e) and was commonly owned. Applicants prefer to refer to WO 99/50711 instead.

Applicants have obviated this rejection by the amendment to claim 1.

The Office recognizes that Melisaris never uses a (meth)acrylate without a radical initiator (Office Action, page 10, lines 4-5 from the bottom). Melisaris defines radical initiators (page 15, line 8, through page 16, line 16) using the same terms that appear in claim 1 as amended. In the Examples Melisaris uses exclusively "base resin" SL 5210, which contains the radical initiator α,α -dimethoxy- α -phenylacetophenone. Claim 1 as amended excludes acetophenones and excludes the radical initiators as defined by Melisaris. Melisaris discloses sulfonium salts as cationic initiators (page 12, line 5 from the bottom) but never suggests using a sulfonium salt without a radical initiator. There is no suggestion in Melisaris to omit the radical initiator.

Applicants submit that the secondary references Liu, Smith, Tsao, Crivello, and Smetana are not properly combined with Melisaris because none of the secondary references relate to stereolithography, in which curable compositions are formulated to very strict specifications.

The Office applied the secondary references to support considering certain cationic photoinitiators as sources of radicals. Even if the secondary references could be properly combined with Melisaris, none of these secondary references would have provided any motivation to omit the radical initiators that Melisaris requires. Specifically, the secondary references say nothing about the particular requirements of stereolithography and the expected result of omitting the radical initiators that Melisaris discloses are necessary. The claims as amended therefore are non-obvious over Melisaris and the secondary references.

The Office has considered the comparative test results on page 26 of the specification. The Office considers that Examples 4 and 7 (with and without radical initiator, respectively) show somewhat better results with radical initiator. The Office considers that “some cure would be expected by the art recognized ability of sulfonium initiators to act as free radical initiators” (Office Action, page 12, lines 9-13). The Office considers the test amount of 0.8% cationic initiator as not commensurate in scope with the amounts claimed (Id., lines 14-17).

A *prima facie* case of obviousness is rebuttable by proof of unexpectedly advantageous or superior properties. *In re Papesch*, 315 F.2d 381, 137 U.S.P.Q. 43 (C.C.P.A. 1963). Test data is commensurate in scope with the claims if the data would be reasonably extrapolated to the full scope of the claims ranges. *In re Kollman*, 595 F.2d 48, 56-57, 201 U.S.P.Q. 193, 199-200 (C.C.P.A. 1979); *Ex parte Winters*, 11 U.S.P.Q.2d 1387 (B.P.A.&I 1988).

As explained above, no prima facie case of obviousness has been made out.

Assuming, *arguendo*, that there is a proper prima facie case, it would be rebutted by the test data. The comparison of Examples 4 and 7 does not show a marked improvement in omitting the radical initiator (I-184, 1-hydroxycyclohexyl phenyl ketone); however, the surprising result is that the formulation works at all for making a 3-dimensional part by stereolithography. Melisarís emphasizes the need for the radical initiators as defined therein, and offers no suggestion that a sulfonium salt cationic initiator would suffice absent the radical initiators. Applicants' discovery is beneficial because there are significant commercial benefits in omitting the radical initiator, including greater simplicity in producing stereolithography formulations and a corresponding decrease in production costs.

Here, the test amount is 0.8 % while claim 1 recites "0.1 to 10 percent by weight of a cationic photoinitiator." The upper and lower limits are both within an order of magnitude of the test amount, and therefore are commensurate in scope.

For all the reasons above, Applicants request that the Office withdraw this rejection.

V. CONCLUSION


Applicants submit that the pending claims are now in condition for allowance. If the Office has questions, the Office is invited to call Applicants' Representative directly at (202) 974-6018.

Please charge or credit Deposit Account No. 12-2475 for all fees as needed.

Respectfully submitted,

LYON & LYON LLP

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By: 
Rouget F. Henschel
Reg. No. 39,221

633 West Fifth Street, Suite 4700
Los Angeles, California 90071-2066
202-974-6018

APPENDIX:

MARKED-UP VERSION OF AMENDED CLAIMS

1. (Amended) A liquid, radiation-curable composition comprising:
 - a) 40 to 80 percent by weight of [a liquid component consisting of] one or more than one [polyfunctional] compound having at least two epoxy groups [capable of reacting via or as a result of a ring-opening mechanism to form a polymeric network],
 - b) 0.1 to 10 percent by weight of a cationic photoinitiator or a mixture of cationic photoinitiators comprising a sulfonium salt,
 - c) 2 to 30 percent by weight of a (meth)acrylate compound having [at least one unsaturated group and] at least one hydroxy group [in its molecule],
 - d) [0] 5 to 40 percent by weight of a hydroxy compound having no unsaturated groups;
 - e) 0 to 30 percent by weight of at least one liquid poly(meth)acrylate having a (meth)acrylate functionality of more than 2 and having no hydroxy groups,
 - f) 0 to 40 percent by weight of at least one liquid cycloaliphatic or aromatic di(meth)acrylate having no hydroxy groups, and
 - g) 0 to 10 percent by weight of a reactive diluent,wherein the sum of components a), b), c), d), e), f) and g) is 100 percent by weight, and components c), d), e), f) and g) are different, and
the composition contains no free radical initiator selected from the group consisting of benzoin, acetophenones, benzil, benzil ketals, anthraquinones, triphenylphosphine,

benzoylphosphine oxides, bisacylphosphine oxides, benzophenones, thioxanthenes, xanthenes, acridine derivatives, phenazine derivatives, quinoxaline derivatives, 1-phenyl-1,2-propanedione 2-O-benzoyl oxime, 1-aminophenyl ketones, 1-hydroxy phenyl ketones, and ionic dye-counterion compounds.

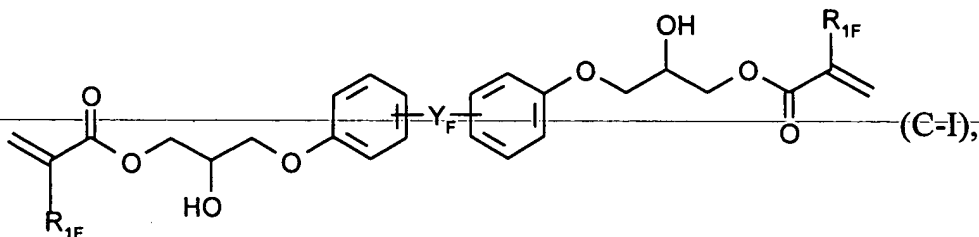
10. (Amended) A composition according to claim 1 comprising
- (a1) 20 to 60 percent by weight of [an] one or more aromatic [difunctional or more highly functional polyglycidyl ether or of a liquid mixture consisting of aromatic difunctional or more highly functional] polyglycidyl ethers having two or more epoxy groups,
 - (a2) 0 to 50 percent by weight of an aliphatic or cycloaliphatic glycidyl ether,
 - (c) 3 to 30 percent by weight of a compound or mixture of compounds having at least three unsaturated groups and a hydroxyl group [in its molecule],
 - (d) 5 to 40 percent by weight of a cycloaliphatic compound having at least 2 hydroxyl groups and/or of a compound that is the product of reacting a cycloaliphatic compound having at least 2 hydroxyl groups [which is reacted] with ethylene oxide, propylene oxide or with ethylene oxide and propylene oxide,
 - (e) 4 to 30 percent by weight of at least one liquid poly(meth)acrylate having a (meth)acrylate functionality of more than 2,
 - (f) 0 to 20 percent by weight of one or more di(meth)acrylates.
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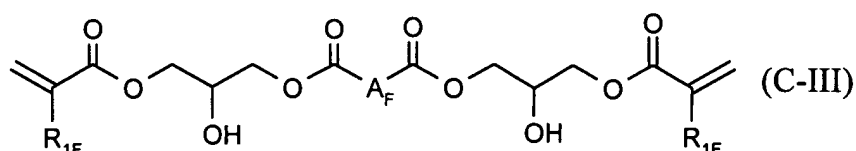
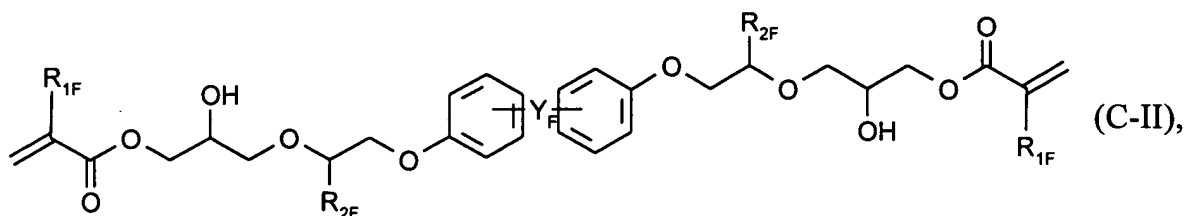
11. (Amended) A composition according to claim 1, comprising:

- (a) 40 to 80 percent by weight of [an] one or more aliphatic and/or cycloaliphatic [difunctional or more highly functional] glycidyl ether having two or more epoxy groups [or of a mixture of such resins],
- (b) 2 to 7 percent by weight of a cationic photoinitiator or of a mixture of cationic photoinitiators,
- (c) 3 to 30 percent by weight of a compound or mixture of compounds having at least three unsaturated groups and a hydroxyl group [in its molecule],
- (d) 10 to 20 percent by weight of a compound that is the product of reacting a phenolic compound having at least 2 hydroxyl groups [which is reacted] with ethylene oxide, with propylene oxide or with ethylene oxide and propylene oxide,
- (e) 4 to 10 percent by weight of at least one liquid poly(meth)acrylate having a (meth)acrylate functionality of more than 2, and
- (f) 4 to 10 percent by weight of one or more di(meth)acrylates.

12. (Amended) A composition according to claim 1 wherein component c) contains a compound selected from the group consisting of

- i) hydroxyl-containing (meth)acrylates of the formulae





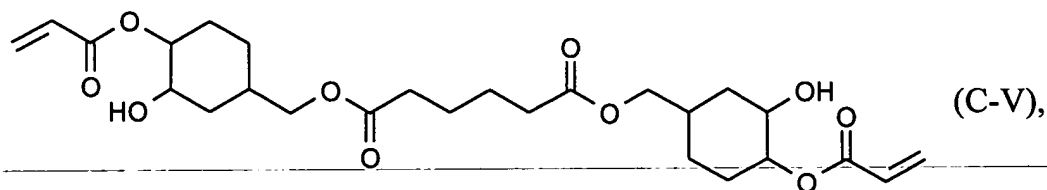
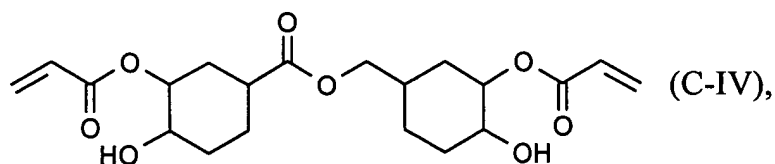
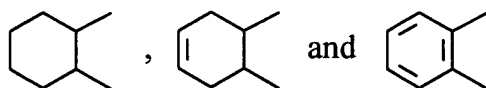
in which

R_{1F} is a hydrogen atom or methyl,

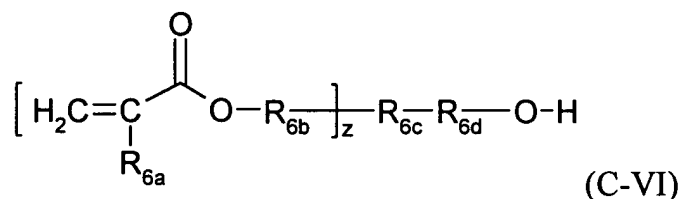
Y_F is a direct bond, C_1 - C_6 alkylene, $-S-$, $-O-$, $-SO-$, $-SO_2-$ or $-CO-$,

R_{2F} is a C_1 - C_8 alkyl group, a phenyl group which is unsubstituted or substituted by one or more C_1 - C_4 alkyl groups, hydroxyl groups or halogen atoms, or is a radical of the formula $-CH_2-OR_{3F}$ in which R_{3F} is a C_1 - C_8 alkyl group or phenyl group, and

A_F is a radical selected from the radicals of the formulae

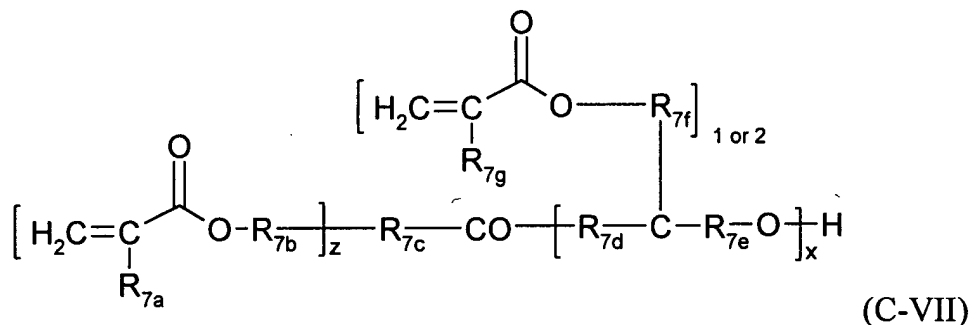


ii) hydroxyl-containing (meth)acrylates according to the formulae



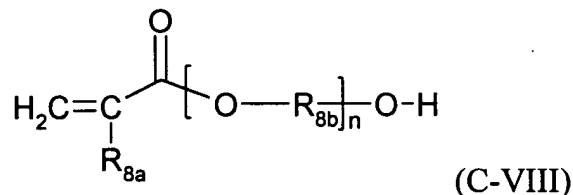
wherein R_{6a} is H or $\text{C}_1\text{-C}_4$ alkyl, R_{6b} and R_{6d} are, independently of one another divalent linear or branched linking groups having 1 to 20 carbon atoms that are optionally substituted one or more times with $\text{C}_1\text{-C}_4$ alkyl, hydroxyl or interrupted one or more times by a carbonyl group, R_{6c} is a multi-valent linear or branched group having 1 to 4 carbon atoms, z is an integer from 1 to 3;

or according to the formula



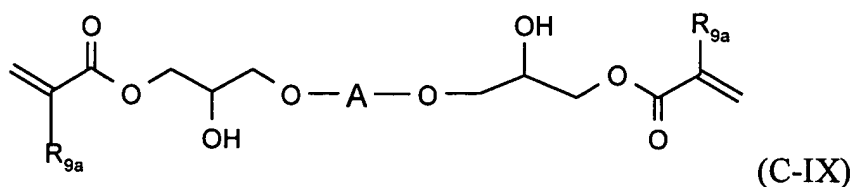
wherein R_{7a} and R_{7g} are independently of one another H or $\text{C}_1\text{-C}_4$ alkyl, R_{7c} is a multi-valent group having 1 to 4 carbon atoms; R_{7b} , R_{7d} , R_{7e} and R_{7f} are, independently of one another, divalent linear or branched radicals having 1 to 20 carbon atoms that are optionally substituted one or more times with $\text{C}_1\text{-C}_4$ alkyl, hydroxyl or interrupted one or more times by a carbonyl group; x is an integer from 1 to 4 and z is an integer from 1 to 3,

or according to the formula



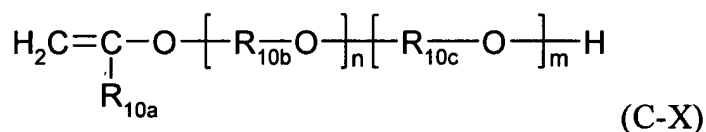
wherein R_{8a} is H or $\text{C}_1\text{-C}_4$ alkyl and R_{8b} is a divalent linear or branched group having 2 to 6 carbon atoms,

or according to the formula



wherein R_{9a} is H or C_1 - C_4 alkyl and A is a divalent linear or branched linking group having 2 to 10 carbon atoms,

iii) hydroxyl-containing vinyl ethers according to the formulae



wherein [x and y are integers from 0 to 20,] R_{10a} is H or C_1 - C_4 alkyl, R_{10b} is an aliphatic group having 3 to 10 carbon atoms, R_{10c} is a cycloaliphatic, aromatic, aliphatic-aromatic or aliphatic-cycloaliphatic group having 5 to 24 carbon atoms, n is an integer from 0 to 5 and m is an integer from 0 to 5 and

iv) hydroxyl-containing poly(meth)acrylates obtained by replacing at least some of the available hydroxyl groups of the compounds of formula (C-I) to (C-IX) with epoxy groups.